tres are affected? Or is the explanation to be found in the fact, that the child not having learned to talk, the right brain takes up a function naturally performed by the left, as in the case of dogs, in which Soltmann found that extirpation of motor centres on one side, caused permanent hemiplegia when they had reached a certain age, but when the experiment was performed on new born pups, before they could walk, no hemiplegia was noticed subsequently.

One class of symptoms in Case II, has not yet been noticed, as they are of later origin and do not affect the diagnosis of the condition at an earlier period. I refer to the changes in sensation and in motor power which began two years ago. These are evidently the results of secondary changes, probably of the nature of sclerosis. About the same time the epileptiform headaches commenced. Is not this a clew to the conditions giving rise to epileptic attack later in life, in other cases of infantile hemiplegia following convulsions of cerebral origin?

ART. II.—NOTE ON THE PHYSIOLOGY OF THE RESPIRATORY APPARATUS.

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In that classical work (*Bemerkungen ueber die Thaetigkeit der Automatischen Nervencentra inbesondere ueber die Athmenbewegungen*, von Dr. J. Rosenthal, Erlangen, 1875), on the physiology of the respiratory movements, Rosenthal's conclusions were that the movements of respiration were excited by the irritation of the blood upon the nerve centres of respiration. The transmission of this irritation to the muscles and nerves concerned, suffered a resistance through which the continual excitation was changed into a rhythmical action. This resistance is increased through the action of the superior laryngeal and diminished through the pneumogastric. A continuous irritation transmitted by the pneumogastric in a centripetal direction, increases the number of respirations through diminution of the resistance. The relations of the vagus to respiration have been the subject of many experiments. Many good observers, on irritating the central end of the pneumogastric, saw the diaphragm stop in the position of inspiration, whilst others saw it stop in expiration. Aubert saw it sometimes in one position and sometimes in another.

Rosenthal saw the diaphragm also in the position of inspiration, but thought it a false experiment because the current spread to the superior laryngeal and thus could produce it. He thought that when the central end of the pneumogastric was irritated that the diaphragm was always in a state of tetanus, relaxation ensuing from central irritation of the superior laryngeal. If when a T shaped tube is inserted in the trachea of an animal and vigorous artificial respiration set up for a few minutes and then stopped, you will notice that no movement of respiration takes place for thirty seconds up to a minute. This cessation of respiration was called in 1864 by Rosenthal, apnœa. He believes that the activity of the respiratory apparatus is dependent on the amount of oxygen in the blood. Here the blood in apnœa is surcharged with oxygen and the respiratory centres are inexcitable, consequently there is no movement for some time. Their inexcitability is so great that central irritation of the pneumogastric calls out no reflex action through the phrenic on the diaphragm. Hering and Beuer* have shown that if after an animal is in a state of apnœa, that sudden and continuous dilation of the lungs will be followed as the first movement by expiration at the end of the apnœic state. If on the contrary the lungs are sucked out and kept so, the first movement at the expiration of the apnœa will be an inspiration. They found that after section of vagi these experiments totally failed. Here change of volume of the lungs influences the respiration through nerves running in the vagi; that is they contain fibres which carry antagonistic impulses in a centripetal direction; the one causing an expiratory movement, the other an inspiratory movement. In my experiments on this

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**Die Selbststeuerung der Athmung durch den Nervus Vagus.*

subject I made use of the following method: the rabbit or dog was narcotized by sub-cutaneous injection of morphia, a T shaped canula inserted into the trachea, one arm of which was in connection with a Fick kymograph, which registered the respiratory movement on the drum of Ludwig's registering apparatus, whose rapidity of revolution was noted every second by the electro magnet of Baltzar and Schmidt. The other limb of the tube was in connection with the artificial respiration apparatus. The current of air was generated by the flow of water after the manner of a Sprengel blower. To make this current of air rhythmical, it was broken by an electro magnet and metronome, the latter after the arrangement of Prof. Bowditch, of Harvard medical school. Then when apnœa was induced, the lungs dilated and the respiratory tube closed, the first movement at the end of the apnœa was an expiration. If apnœa was again induced, the lungs swelled out and the respiratory tube closed, the Feder kymograph always registered an inspiration. Section of the pneumogastrics caused complete failure of these experiments.

These results confirmed completely the view that in the pneumogastric are fibres carrying inspiratory and expiratory impulses to the medulla.

Influence of respiration on the circulation: Hering,* in making experiments similar to those detailed, found that dilation of the lungs increased the rapidity of the heart's movements, which measure failed to take place after section of the pneumogastrics. With the very able assistance of Dr. W. H. Klapp, I made some experiments on this point with the apparatus arranged as previously described. The carotid was put in connection with Traube-Ludwig's mercurial manometer, which registered the pressure and pulsation on the same drum that received the tracings of the respiratory movements. After apnœa was produced, the lungs were dilated, and the blood pressure immediately fell, and the pulse was considerably increased in frequency. On section of the vagi this did not take place.

These experiments confirm the view of Hering that the irritation of the ends of the sensory nerves in the lungs, stand in relation to the cranial inhibitory centre of the heart; that is, the inhibitory centre of the heart in the brain has its tonus lowered and allows the heart to run faster.

**Ueber den Einfluss des Athmungs auf den Kreislauf.*

In an examination of twenty-four cases of glass-blowers, tabulated by Dr. DaCosta,* I find that in eleven the pulse ranged from 90 to 116 per minute. The cause of this frequency is very beautifully shown by the preceding experiments. The great dilation of the lungs in the blowing of the glass irritates the endings of the sensory nerves in the lungs, which irritation being carried to the medulla diminishes the tonus of the cardio-inhibitory centre situated there. Now it is well known that the inhibitory power of the vagus in man is very great, and it is probable that its power varies in different individuals, which would explain why the thirteen other glass-blowers showed no acceleration of their heart. Now, as this performance is kept up many hours daily for a series of years, it is easy to conceive that the cardio-inhibitory centre in the brain receives such a diminution of irritability so often that it would at length remain constantly in such a condition. Frequent irritations exhaust all nerve centres. This action, expressed in a few words, I believe to be the true explanation of the cardiac frequency in glass-blowers. The following resume expresses my conclusions:

1. That as Hering and Beuer have shown the pneumogastrics contain fibres which carry antagonistic impulses from the lungs to the respiratory centres in the brain, calling out both inspiration and expiration, that dilatation of the lungs increase the heart's frequency, and that the cause of this is that the pulmonary sensory nerves carry irritations to the brain, which reduce the instability of cardio-inhibitory centre seated there.

2. That the rapidity of the heart in glass-blowers is due to a lowered tonus of the medullary cardio-inhibitory centre, which has been produced by the frequent irritations of the sensory nerves ending in the lungs, by the act of blowing.

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**Toner lecture.*